

QUALITY ASSURANCE AUDIT OF APIOS DEPOSITION MONITORING NETWORKS

Prepared For:

Ontario Ministry of the Environment
Air Resources Branch

Prepared By:

The Environmental Applications Group Ltd.

MOE
APIOS
QUA
APBK

March 1988

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QUALITY ASSURANCE AUDIT OF APIOS DEPOSITION
MONITORING NETWORKS

Prepared by
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for

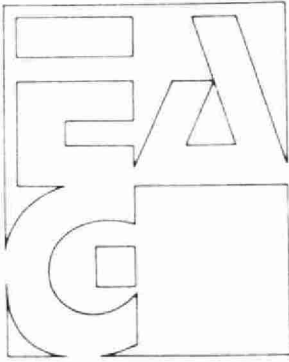
ONTARIO MINISTRY OF THE ENVIRONMENT
Air Resources Branch
880 Bay Street, 4th Floor
Toronto, Ontario

March 1988



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THE ENVIRONMENTAL
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March 31, 1988

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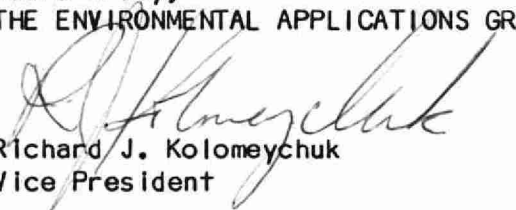
Attention: Mr. D. Orr

Dear Mr. Orr:

We are pleased to provide the Ministry with the final report of the results of our external audit. Comments from APIOS personnel regarding information presented in the draft report were considered and incorporated in this final document when appropriate.

There are several basic recommendations that we have formulated from our examination of the system. Overall, the network is operating in a cohesive and standard manner with some difficulties, mostly minor in specific areas.

Yours truly,
THE ENVIRONMENTAL APPLICATIONS GROUP LIMITED



Richard J. Kolomeychuk
Vice President

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Encl.

734-LET2

SUMMARY

The Environmental Applications Group Limited was contracted by the Ontario Ministry of the Environment (MOE) to carry out a quality assurance audit of the cumulative and event monitoring networks of the Acidic Precipitation in Ontario Study (APIOS).

The main emphases of the audit were site representativeness and operation. The sites were visited from mid-August through to the end of October 1987 and included the following locations:

Cumulative Network	Event Network
Colchester	Charleston Lake
Uxbridge	Longwoods
Geraldton	Fernberg
Dorset	Dorset
Bear Island	Wilmer
Cloyne	Dawson
Turkey Lakes	

The regional offices in Thunder Bay, Sudbury, London, Kingston, and the Dorset and Toronto offices were also visited and procedures monitored.

In general, the majority of sites and operations were found to conform with the objectives of the APIOS monitoring network and established standard procedures. Of the twelve locations audited, one site obtained a poor rating, three marginal ratings, seven good ratings, and one an excellent rating. At these locations, operations were rated to be poor at one, marginal at four sites, good at six sites, and excellent at one location. Operations at the office were also evaluated and three offices were given a good rating and three were given an adequate rating (Dorset and Toronto are included in this evaluation). Poor and marginal ratings for sites, operations and offices should be investigated by the APIOS quality assurance coordinator and remedial actions instituted where possible.

The regionalization of APIOS operations in southern Ontario has not been beneficial to the network. APIOS monitoring receives a low priority in comparison with more immediately pressing regional needs. This is not the case in the northern regions, where the technicians spend a majority of their time on the APIOS monitoring network.

The conclusions of this audit are that the majority of sites are in conformance with representative criteria and operations are providing standardized data across the province. There are some problem areas which have been delineated for remedial action in order to improve the monitoring networks and their operation.

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1.0 INTRODUCTION

1.1 Background

The Environmental Applications Group Limited (EAG) conducted an external audit of the Acidic Precipitation in Ontario Study (APIOS) monitoring network for the Ontario Ministry of the Environment (MOE). The site audits were conducted during the late summer and early fall of 1987.

In accordance with the quality assurance objectives of the APIOS deposition monitoring network (Bardswick, 1987), this external audit was carried out to verify that sites are meeting acceptable criteria, that equipment and procedures are sound and that standard operating procedures are used.

The work program of EAG consisted of the following items:

1. Evaluate the representativeness of the 12 sites indicated in Table 1 (Figure 1 provides the locations) by conducting field visits and evaluating site documentation. These sites were specified by MOE.

TABLE 1
Site Visits

Region	Site	Instrument Configuration
Southwest	Colchester	Cumulative wet and dry
	Longwoods	Event wet and dry
Central	Dorset	Event/Cumulative wet/dry
	Uxbridge	Cumulative wet and dry
Southeast	Cloyne	Cumulative wet and dry
	Wilmer	Event wet
	Charleston L.	Event wet and dry
Northeast	Bear Island	Cumulative wet
	Turkey Lakes	Cumulative wet and dry
Northwest	Geraldton	Cumulative wet and dry
	Dawson	Event wet
	Fernberg	Event wet and dry
	(Minnesota)	

FIGURE 1

**APIOS NETWORK STATION LOCATIONS
AUDITED**



2. Evaluate APIOS field operations, check flows in air sampling equipment and verify proper documentation of operating procedures and their distribution to personnel in the field program.
3. Evaluate the performance of technicians and their assistants in each of the regions.
4. Determine if the recommendations of the audit report of 1984 were carried out.
5. Prepare a report documenting the results of the audit.

1.2 Audit Procedure

The audit takes a snapshot of the working of the network through a representative cross-section of sites and personnel. Through this procedure, any existing major problem areas will hopefully be identified.

Site questionnaires developed by Concord Scientific Corporation (1984) for previous audits were used in the present effort after consultation with the APIOS Technical Coordinator (same person as the APIOS Quality Assurance Coordinator). These forms provide a systematic basis of recording site and instrument information. Two external auditors, experienced in standard procedures and monitoring networks, conducted the surveys.

The questionnaire encompasses the major following areas:

Site Description
Equipment Operation
Operator Performance

Site descriptions encompass identification, local feature details, and sampling influences. During the audit, site sketches were made and photographs were taken of the equipment and sites. In addition, aerial photographs and forestry maps were obtained and scrutinized with respect to possible site influences of a local nature.

Equipment inspection comprised dry deposition monitor flow checks, wet sampler checks, configuration assessment, maintenance evaluation, and other operation checks. Wet sampler checks devised by Concord Scientific (1984) were used in this survey with the exception of resistance checks. During the audit, EAG used an APIOS mass flowmeter to check the flows of low volume and sequential samplers at the audited sites. Checks on flows in the field cannot be considered to be a calibration. The flowmeter exhibits considerable drifting in the field, probably due to temperature variations. This behaviour does not occur in a controlled laboratory setting.

The performance of the flowmeter at low flows (0 to 2.5 lpm) was verified in EAG's laboratory using a water displacement technique. The time taken to pump a known volume of water into a flask, by displacement of air drawn through the flowmeter, was measured with a stopwatch, and the observed flowrate was compared with indicated meter reading. The two results were within 5 percent over the range of flows tested.

Siting and operation of sites were rated using the scheme of the second audit (CSC, 1984) which provides for excellent, good, marginal, and poor levels. In the case of poor ratings changes should be made immediately to remedy the situation. Marginal ratings are an alert that potential problems exist and procedures should be reviewed as soon as possible by the QA coordinator. Office operations were rated according to the same scheme.

The ratings for both sites and operation are based primarily on observations on the days of the audit. Consideration is given to information provided by the Technical Coordinator and the regional technicians, and operators but the major factors are the perceptions of the auditors at the specific time of the audit. These ratings may not be consistent with a weighted seasonal appraisal.

1.3 Report Format

The components of the audit are divided in those related to performance such as sample collection and site representativeness and those of systems nature such as documentation and investigating the recommendations of the previous audit. The performance related items are reported in Section 2 of this report while systems elements are provided in Section 3. Descriptions in Section 2 include information assessed by the auditors to be important in determining a site or operation ranking. Regional and technical personnel should refer to the Appendix 1 to all identified problems at a site.

Site surveys in Section 2 encompass recommendations specific to each office or site. These recommendations are not repeated elsewhere unless the recommendation is applicable on a network basis. In this case, it is repeated in Section 3. A sub-section of the third chapter highlights general observations and recommendations.

Two appendices were provided under separate cover. The first Appendix includes completed audit surveys and questionnaires while the second Appendix provides photographs of the audited sites.

2.0 PERFORMANCE AUDIT

2.1 Site Audits

The site visits included audits and evaluations of the sites, operator sample handling procedures, monitor configurations and instrument performance. The questionnaire-audit check list used is the same employed during previous APIOS audits by Concord Scientific Corporation (CSC, 1984).

2.1.1 Southwest Ontario Region

2.1.1.1 Colchester

Instrumentation. Cumulative wet and dry.

Siting.(Rating: Marginal)

A location sketch and overview photograph are provided in Figure 2 and Plate 1.

The site is located at a water treatment plant in a village.

The marginal rating is given due to the presence of possible on-site interferences (overhead wires nearby and the use of chemicals containing sulphate and chlorine in the operation of the plant) and due to human activity in the area surrounding the site as shown in the photographs in Appendix 2 (homes visible to the north, west and south; roads visible to the north, west and east).

Recommendation

Since the operator works at the site during the day he should be advised to be aware of the activities near the site which may influence sample quality, and to note these, should they occur, on his sample sheets.

For Future Consideration

Substantial changes may occur at the Colchester site in the future. There is a plan to provide sewers in the village in the next couple of years. When this takes place there will be substantial fugitive dust releases from construction and truck traffic in the vicinity. A sewage lagoon is planned to be located at a distance of 3 to 4 kilometres from the site in a west to southwest direction.

Operation.(Rating: Marginal)

The site is poorly maintained and supported by the London office. The operator was not clear as to whether site technical support was provided by the office in London or in Windsor. His telephone contact is the regional technician in London, but this

COLCHESTER

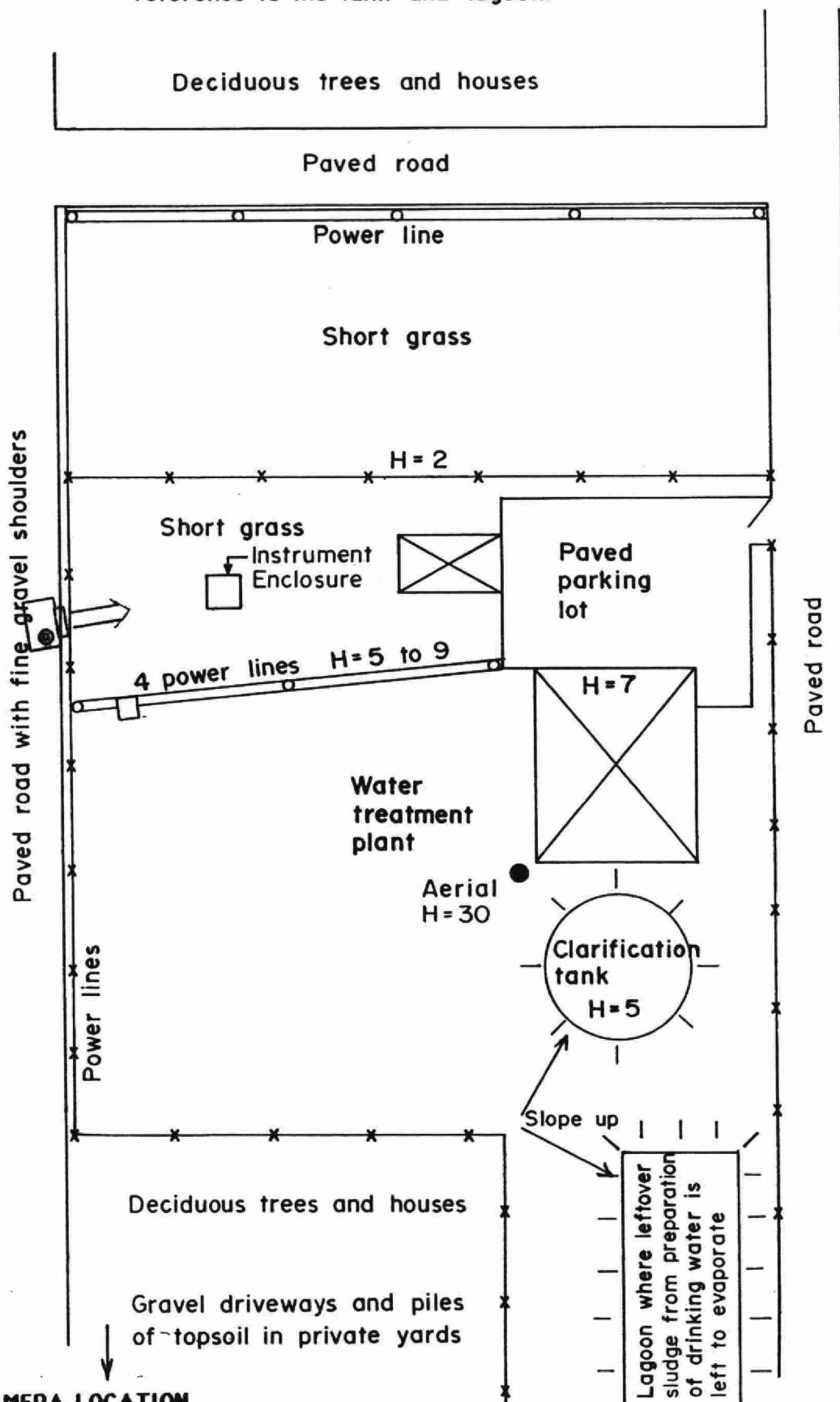
Figure 2

All heights are in metres above grade

Drawing is to scale within 40 m of sampler, and with reference to the tank and lagoon.

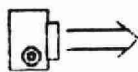
Soybean
Field

Deciduous trees and houses



Large open areas, dirt field

0 15m



CAMERA LOCATION
AND DIRECTION

Plate 1

COLCHESTER



is not the person who visits the site on a monthly basis. Examples of poor maintenance are given below.

Site maintenance such as placing and removing the Nipher shield is carried out by the operator, or not at all (see Appendix 2). After no action was taken on the problem of repeated faults on the GFIC breaker (noted on forms sent in with the samples) the operator replaced the breaker with a regular one. The operator does not know about the use of ethanol for the winter-time cleaning procedures. He stated that in the winter-time the deionized water freezes during the cleaning procedure and so he does not clean the gasket. He has not had the standard procedures reviewed with him in over a year.

The operator at this site does not make sufficient observations regarding changes at the site which may influence the sample quality. He has not been informed as to the possible influences of the anthropogenic activity nearby on the sample quality, and the advantages of having such observations. As well he does not keep a log of the routine maintenance which he carries out (for example - changing the gasket).

The relief operator was observed smoking just outside the instrument enclosure and was advised not to do so.

The operator at this site is quite enthusiastic and capable, but his interest is waning since he says that "no one else cares about the site so why should I?".

Recommendations

The operator is due for retraining, and needs more communication with the technician, or his designated representative. This communication should include a periodic review of his activities such as record-keeping.

More technical support is needed at this site in terms of routine site maintenance. This could be provided either by the London office directly, or after a suitable definition of duties and appropriate training, by the operator.

NO SMOKING NEARBY signs should be posted at the instrument enclosure.

Criteria for Improvement of Rating

If the above recommendations are carried out the rating of site operations can be upgraded to good.

2.1.1.2 Longwoods

Instrumentation. Event wet and dry.

Siting(Rating: Good)

A location sketch and site photograph is provided in Figure 3 and Plate 2.

The site is located in a conservation area surrounded by farmland.

There is a dirt road in the park, visible to the south and east of the site. Considerable dust is raised when vehicles travel quickly down the road. Most of the traffic observed at the time of the audit was due to activities by the park personnel.

There are tall trees (approx 32 m tall) near the precipitation collector (approx 15 m away to the east).

Recommendations

Post a speed limit on the road, and advise the park employees as to the possible effects of dust on the sampling results.

Move the wet sampler to the clear area immediately to the south. If this is not possible then a further assessment of the possible effect of the trees on the sample quality should be made. Of concern is the possibility of rain, which has washed the leaves, falling into the collector.

Operation (Rating: Marginal)

This site has two operators: one for the event wet sampling and another (the regional technician) for the event dry sampling.

The event wet operator does not demonstrate sufficient care in keeping the samples clean. The sample bag is set on a dusty, gritty, table top, and is not rinsed with deionized water prior to the corner being cut. Rusty scissors are used to cut the bag. Kimwipes and gloves are not changed frequently enough to ensure that contamination cannot be introduced.

The event bag fit poorly when installed, leaving approximately 10 percent reduction in surface area. The operator does not smooth the bag down. The bungy cord is not consistently placed in the groove provided (the bungy cord is sometimes placed below the groove).

Maintenance needs are noted in several areas. Some of the lights are burned out in the sequential sampler; the raingauge support is loose enough that the gauge level would have to be checked after each measurement; the Teflon surface provided in the hut as a clean surface for event wet sample handling is badly worn, with wood chips showing through; the hut is generally dusty. There is no deionized water available at the site to rinse the corner of

LONGWOODS

Figure 3

Diagram is only to scale within 30 m of wet and dry samplers.

All heights are in metres above grade.

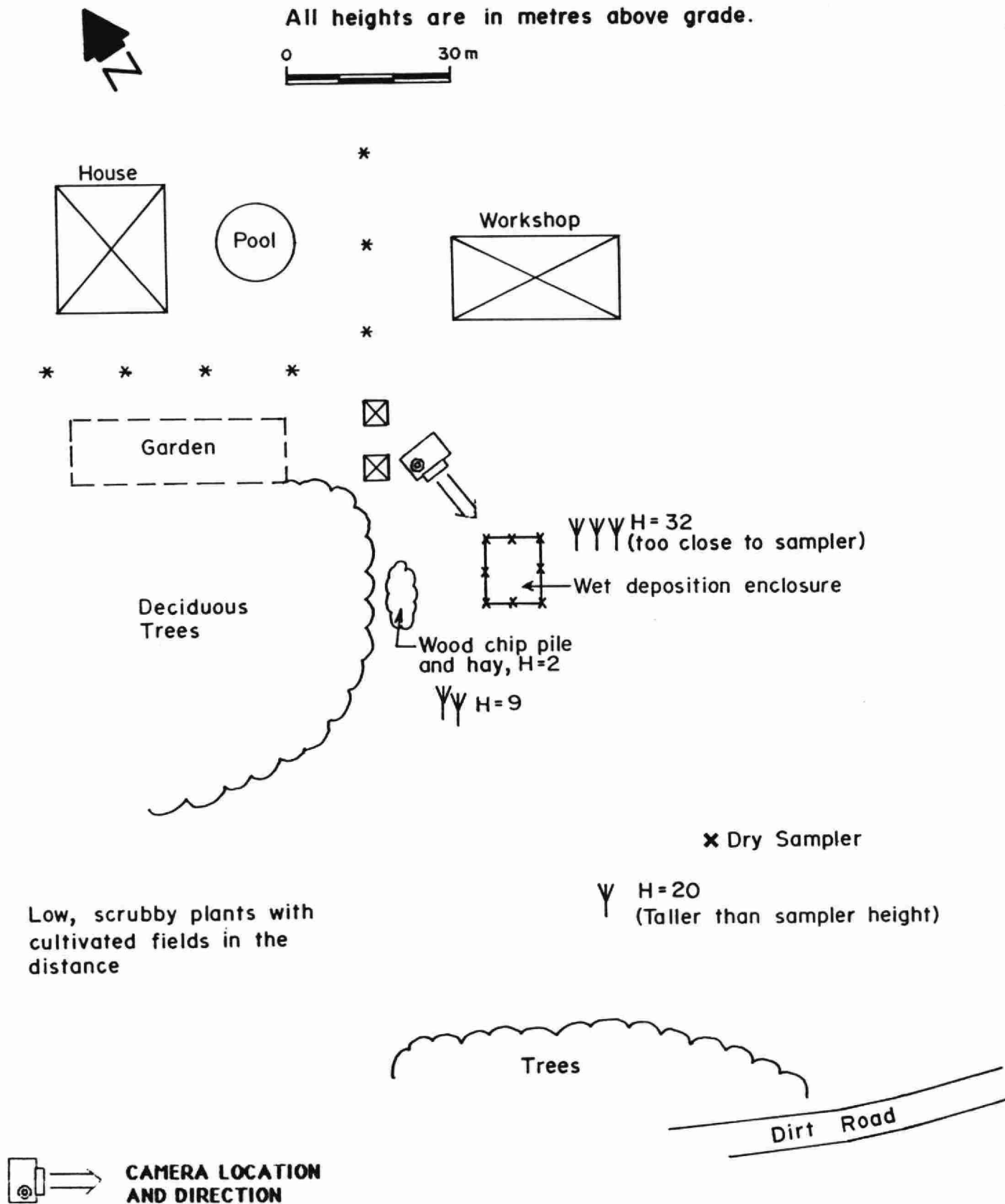


Plate 2

LONGWOODS



the bag, or to wash the gasket.

The gasket seal is not tight on the wet collector, leaving gaps through which insects or dust can enter the sample bag.

Both the technician and the operator drive right up to the samplers. This can cause sample contamination due to the NOx emissions from the exhaust, and is causing problems with the grass ground cover near the instruments (see photographs in Appendix 2).

The event dry sampling operator followed standard procedures.

Recommendations

The event wet operator should be retrained, with particular emphasis placed on keeping the samples uncontaminated.

Site support, such as handling the maintenance needs described above, should be increased.

The site operators, and all visitors, should walk to the samplers from the parking lot. Vehicles should only be driven up to the instrument enclosure and hut when heavy equipment is being moved.

The event wet operator should have more information regarding the APIOS network, and the results obtained.

Criteria for Improvement of Rating

If the above recommendations are carried out the operations rating can be increased to good.

2.1.1.3 London Regional Office (Rating: Marginal)

The regional office was assessed according to the APIOS-related duties carried out in the office by the regional technician, and support provided to the sites audited .

The technician assigned with APIOS duties sees his responsibilities to the program as being a small part of his overall duties. The technician stated that a part-time contract employee is sharing some of the APIOS work. This contract employee was not available at the time of the audit.

In general, sample handling and measurements are conducted according to standard procedures. One deviation observed was the practice of washing hands with ethanol and rinsing with deionized water and then handling the filter packs with bare hands instead of wearing gloves. However the loading and unloading was done well, with little possibility of contamination. The filters and internal surfaces of the filter packs were not touched in the demonstration during the audit.

The technician has written a program which he uses to calculate the winter gauge depth measurements.

Recommendations

The amount of technical support given to the sites, both in the capacity of operator training, supervision and motivation, and in the capacity of routine site maintenance should be increased. A suggested minimum frequency for training would be every six months, once near the beginning of the summer sampling season, and once near the beginning of the winter season. A full maintenance routine should be carried out for each site twice annually.

The appropriate quality assurance representative should be advised of any changes to the standard methods such as the use of a computer program to do some type of analysis. In a network such as this, where the comparability between results obtained at different sites is important, the performance of the program must be documented at the data management level. As well, if it is a useful tool, it should be implemented throughout the network.

Criteria for Improvement of Rating

The marginal rating for this regional office is not due to procedures as followed in the office, but rather to the lack of maintenance of the sites audited, and the inadequate monitoring of the performance of the operators who were audited. In a monitoring program, such as APIOS, a high level of awareness and competency at the site operator level is crucial to obtaining good quality data. There must be confidence that any variation seen in the data is due to causes other than sample collection and handling protocols in the field.

If the recommendations given above are carried out the rating can be changed to good.

2.1.2 Central Region

2.1.2.1 Dorset

The Dorset site operation is unique in the APIOS network, since it is also used for instrument development, quality assurance studies and other special measurements.

Instrumentation. Event wet and dry; cumulative wet and dry.
Collocated Samplers.

Siting. (Rating: Good)

A location map and overview photograph are provided in Figure 4 and Plate 3.

The site is located in a heavily treed, remote area with lakes

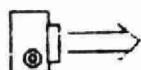
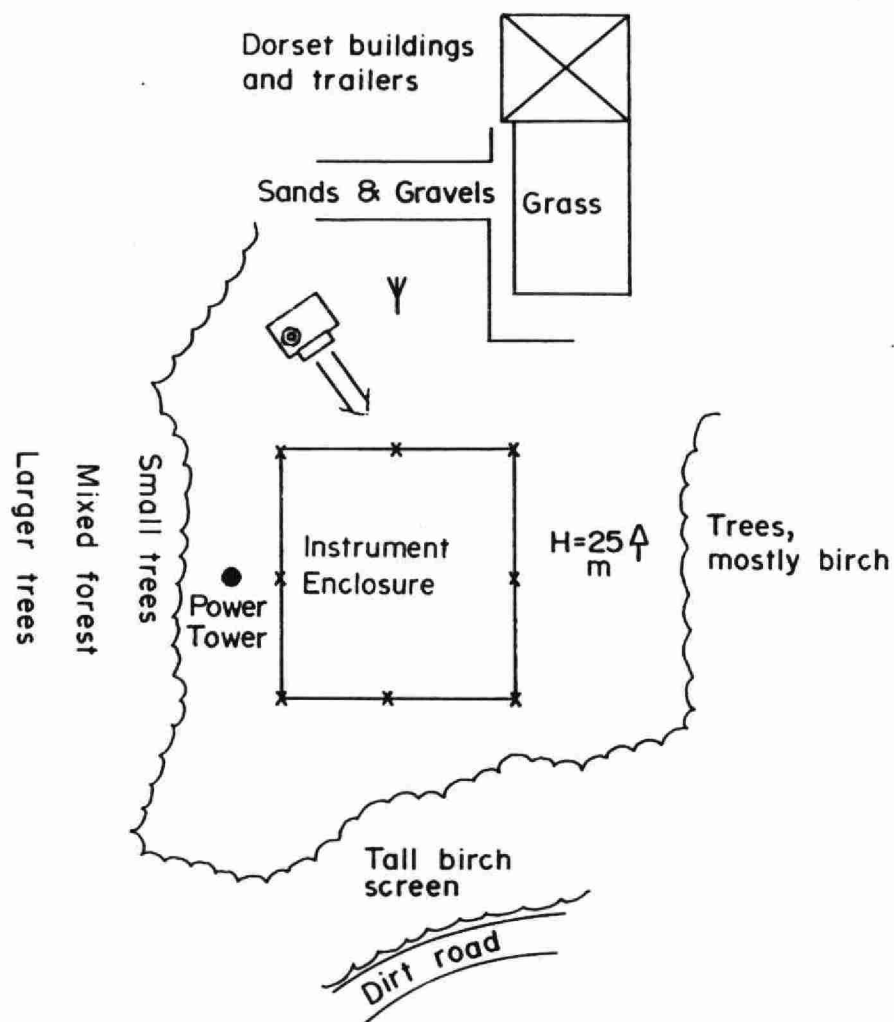
DORSET

Figure 4

Instrument enclosure is flat and raised approximately 1 to 2 m above surrounding flat land

Hills in distance to east and north

Forest to south and west



CAMERA LOCATION
AND DIRECTION

Plate 3
DORSET



nearby.

Dorset monitors are potentially exposed to wind blown dust from sources in the immediate vicinity. There is an open sandy area approximately 50 to 100 m to the northeast of the site, due to recent construction activities, and access roads are either gravel or dirt. During a dry summer such as this one there is thin ground cover in the instrument enclosure itself (see photographs in Appendix 2). During the audit, sodding was being carried out over the ground exposed by the construction activity (see Plate 3).

Operation. (Rating: Good)

The technician operating the site has too heavy a workload to handle alone. He is assisted by a student and an operator who handles the event wet sampling. Under these circumstances the workload is acceptable.

The cumulative gauges at Dorset are fitted with bird screens for summer operation.

The sequential sampler boom has a double head which is very heavy. When released, the boom swings down with a torque which can exceed that applied by the operator. This poses a safety hazard (for example the end of the boom could strike the operator).

The event wet operator rolls the bags up and seals them at the top, allowing the possibility of contamination. This operator uses a single Kimwipe and one pair of gloves to handle five collectors, again providing a mechanism for contamination. The standard procedure is followed, but no provision is made for the fact that multiple samples are handled. These problem areas were discussed with the technician during the audit.

The event wet operator has made a short checklist to cover his operating procedures. It is included in Appendix 1.

The exterior surfaces of the cumulative filter packs are handled with bare hands by the technician and student helper. Both were careful not to touch the filters or internal surfaces.

Instruments in general are operating correctly and are well-maintained. There is a small difference in the collocated low volume cumulative samplers with the primary one sampling at a rate of 2.0 l/min and the secondary one at 2.16 l/min as checked by the mass flow meter. The sampling rate indicated by the rotameter ball on the event sequential sampler did not correspond to the reading of the mass flow meter (possibly due to lower than atmospheric pressure in the tube) but the volume counter, when tested, was correct. The sampling rates noted above were taken with the rotameter ball set to the usual setting as noted on the instrumentation.

Tours of the Dorset instrumentation compound for the general public are routinely carried out by the event wet operator. During the audit he was observed using one of the APIOS samplers for demonstration, and a visitor leaned over the opened bucket. The practice of opening and closing the sampler, and allowing groups to stand nearby increases the chance of sample contamination.

Recommendations

The practice of having an assistant at this site should be continued.

The practice of using very coarse screens to keep birds from falling into the Nipher gauges in the summer time should become standard if it is found acceptable by the quality assurance coordinator. Note that a dead bird was found in the gauge at Geraldton during the audit.

The screens in use in the Nipher gauges should be provided with hook supports at the top to prevent them from being pushed into the fluid in the gauge.

The sequential sampler boom should be rebalanced and a lock should be provided for the raised position to prevent the possibility of injury to the personnel at the site.

The procedures used in the handling of multiple event wet buckets should be reviewed by the technician to ensure that no contamination due to handling can occur.

The procedural checklist in use by the event wet operator should be assessed. If excerpts from this list are found to be useful for general use they should be distributed throughout the network.

The demonstrations of the event wet sampler for the public should be restricted to the secondary sampler only.

2.1.2.2 Dorset Office(Rating: Good)

The technician had a student from Fanshawe College assisting him at the time of the audit. Her duties included weighing the samples, filling in forms, and loading and unloading the filter packs.

The corner of each bag is rinsed with deionized water and dried with a Kimwipe before cutting to pour the sample into the bottle. A single Kimwipe is used for several bags, leading to the possibility of contamination.

When loading and unloading the filter packs the outside of the

filter pack is handled with bare hands. Care is taken not to touch the inside surfaces or the filters. The chance of contamination is small.

The sample handling area is clean, but is located in a large general lab area which is cluttered with equipment and is impossible to clean regularly.

Recommendations

A fresh Kimwipe should be used for each sample bag rinsed.

A separate clean room should be provided for sample handling.

2.1.2.3. Uxbridge

Instrumentation. Cumulative wet and dry.

Siting. (Rating: Poor)

A location sketch and overview photograph are provided in Figure 5 and Plate 4.

The site is located on private property in a semi-wooded area surrounded by farmland.

There is a visible road 45 m to the north of the site, and a private residence and a swimming pool 30 m to the east. There is a 6 m high cedar hedge 6 m to the west of the samplers. These factors can influence the sampling because of NO_x emissions and dust generation from automobiles, smoke from the fireplace, and the release of chlorine from the pool. The presence of the tall hedge near the collector can influence the catch of the collector.

Recommendations

Trees should be planted near the road to screen the site as much as possible.

The hedge should be trimmed to an acceptable height.

The possibility of sample contamination due to the close proximity to the house and pool should be documented at the data assessment office. The operator should keep a record of activities which can affect the sample quality. This record should take the form of :date, activity type (eg. barbeque), time, duration, estimated observed wind speed and direction. The operator should be advised as to which activities can affect sample quality.

Figure 5

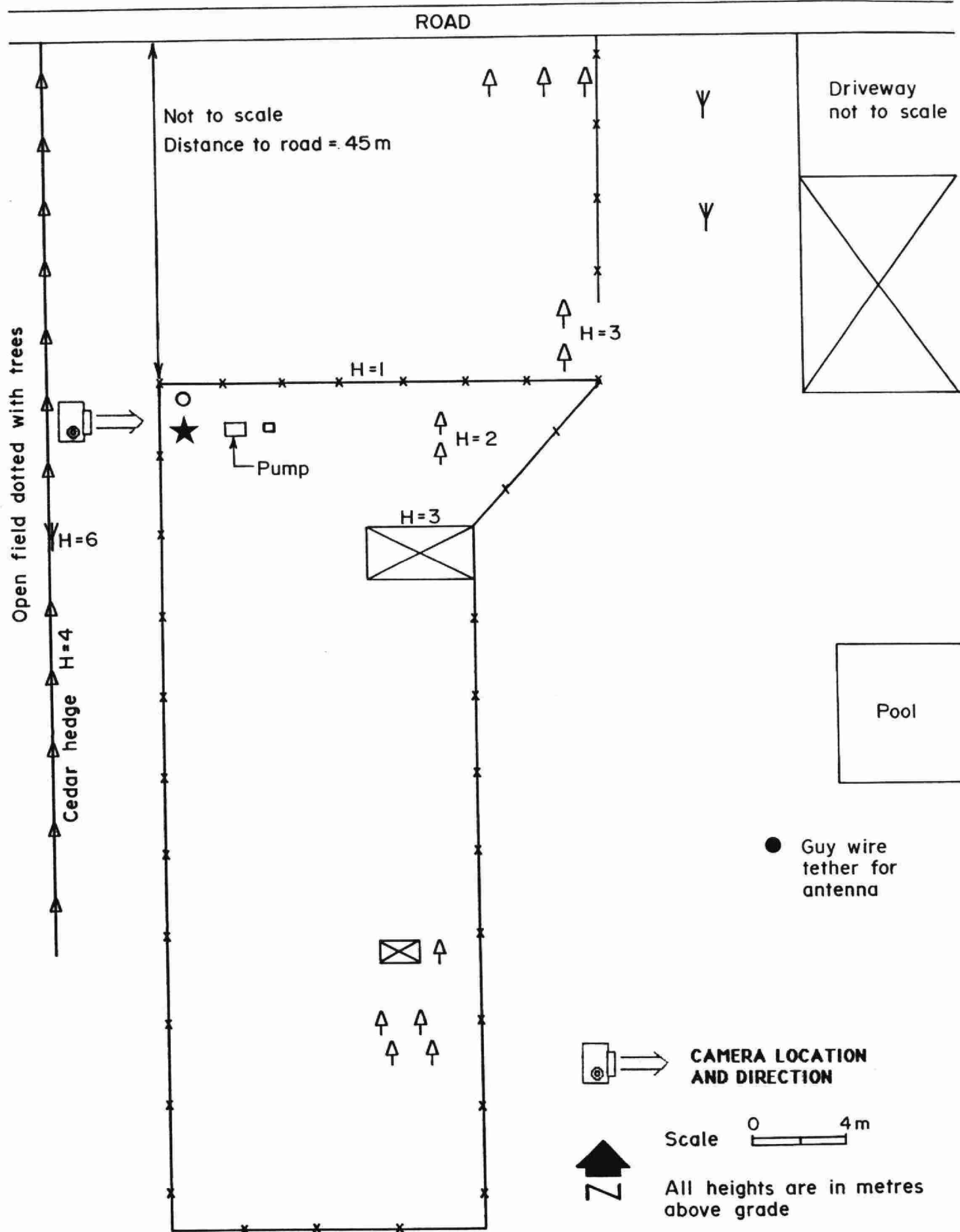


Plate 4
UXBRIDGE



Criteria for Rating Upgrade

If the above recommendations are carried out the site rating can be changed to marginal. If, in addition, the road can be fully screened from the site and the operator can minimize activities which affect sample quality then a rating of adequate could be considered.

For Future Consideration

The operator (the property-owner) is planning to put a pond to the south of the monitoring site at an unspecified future date.

Operation (Rating: Poor)

There are various items which need maintenance at the site. For example, the lock washers on the cumulative wet collector hood are rusting, the sample collection vessel is not taped to reduce heat absorption and the Nipher gauge is not level. The instruments are surrounded by weeds up to 1 m tall, introducing the possibility of contamination by pollen.

The operator was observed making a gauge depth measurement incorrectly. She does not know the names of her contact people, only the telephone numbers. At the time of changeover she was observed to have great difficulty removing the filter pack, with the consequence that it came off disassembled. Drops of water were observed inside the filter pack, touching the filter.

Problems with this site were discussed with the technician responsible in November.

Recommendations

The technician should visit the site to perform maintenance and monitor the performance of the operator on a regular basis. The minimum frequency of full maintenance routine and complete review of procedures should be every 6 months. Note that the operator received her initial training in February of 1987, and a retraining session was already called for by the time of the audit (September 1987). It is recommended that all new operators have their performance evaluated by the technician within two months of initial training.

Communication with the operator should be improved.

Criteria for Rating Upgrade

If the recommendations given above are implemented the rating can be upgraded to good.

2.1.2.4 Toronto Office (Rating: Marginal)

Filter cutting for the APIOS monitoring network and Uxbridge site support were audited at the Toronto office. This is the basis for the evaluation and rating given.

Uxbridge Site Support

Unloading of the filter packs was done by contract employees who were not available during the audit visit. The technician was observed carrying out these tasks.

Cumulative precipitation sample bags are sealed in a room where people regularly smoke.

Recommendations

The level of site support in terms of maintenance and retraining should be increased. It is essential for data quality throughout the network that every site be adhering to the standard operating procedures.

Smoking must be prohibited in all sample handling areas.

Network Filter Cutting

The "clean" room in which the filters are prepared has a clean Teflon-coated surface for working on, but the rest of the room is very dusty.

The technician wears the same pair of gloves for all operations in preparing the filters, including the installation of the drill bit.

Recommendations

Ensure that the "clean" room is clean by regular wiping down and sweeping.

Wear clean gloves when handling the sheets from which the filters are prepared.

Criteria for Rating Upgrade

Implementation of the the recommendations given above would improve the rating to good.

2.1.3 Southeast Region

2.1.3.1 Cloyne

Instrumentation. Cumulative dry and wet.

Siting. (Rating: Marginal)

A site diagram and photograph are provided in Figure 6 and Plate 5.

The site is located in a fenced-off yard next to a school parking lot.

The presence of diesel school buses idling in the parking lot is considered an important departure from the siting criterion stipulating minimal sources of air pollution within 1 km of the site. The proximity of secondary Highway 41 (100 metres distant) is also a potential local source of pollutants. During the winter, the majority of residences in Cloyne use wood-burning stoves and fireplaces (information obtained during discussion with the site operator) and the school burns oil for heat. Wood ash is alkaline and contains relatively high concentrations of potassium. Entrainment of wood smoke by the samplers would lead to elevated potassium levels. There is a possibility of vandalism or tampering in this location due to the proximity to the school and open access to the equipment through a gate in the fence.

Recommendation

Access to the site should be restricted by a second fence enclosure.

Operation. (Rating: Marginal)

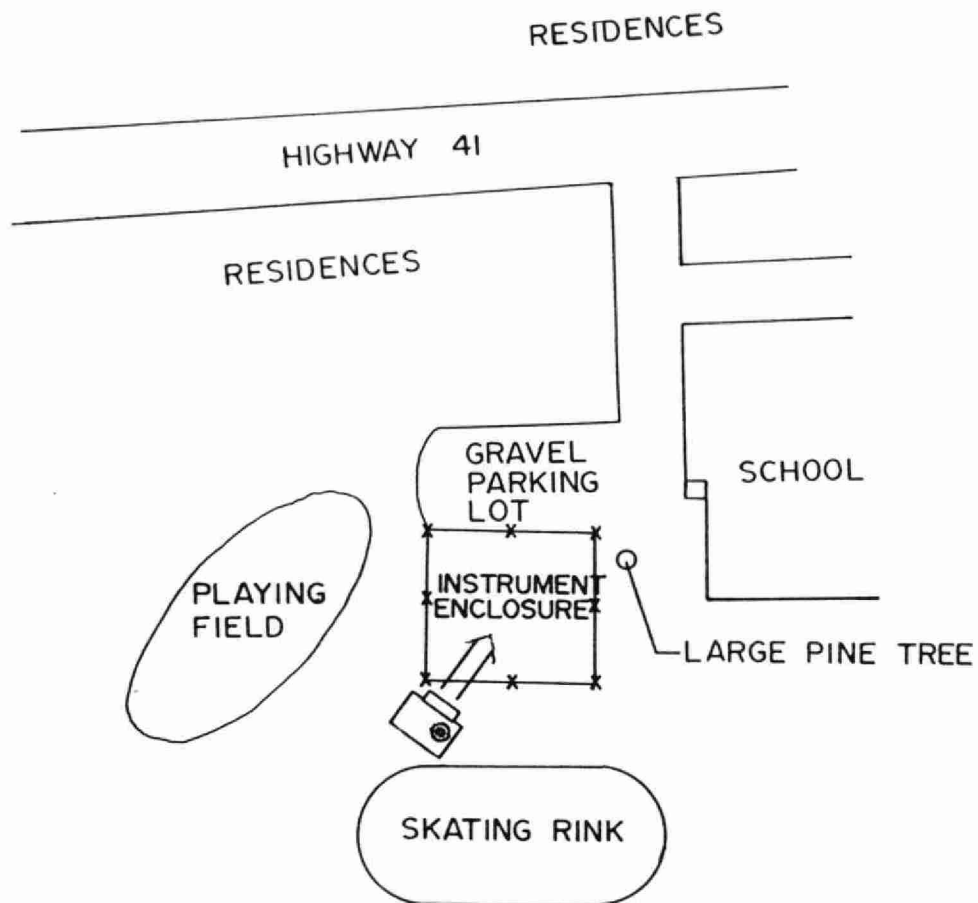
The last time procedures were reviewed with the operator was over 3 years ago. He does not attempt to flatten the bag or clean the collar on the wet sampler. He also believes that he needs more explanation of cleaning procedures.

The operator, on occasion, has run out of Kimwipes and gloves. Supply requests are not promptly filled. The Vacushield on the lo-volume sampler was restricting flow and needed replacement (the technician suggested the potential problem area and the auditor subsequently replaced the Vacushield prior to monitoring flows). The clutch needs adjustment since it required greater than 50 pounds of force to move the sampler hood mechanism. There appears to be only a limited amount of exchange between the operator and the regional technician because the former is at work during the day.

The site was in overall need of minor maintenance i.e. off-level Sangamo and lo-volume sampling head.

CLOYNE Figure 6

0 100 m



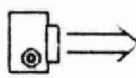
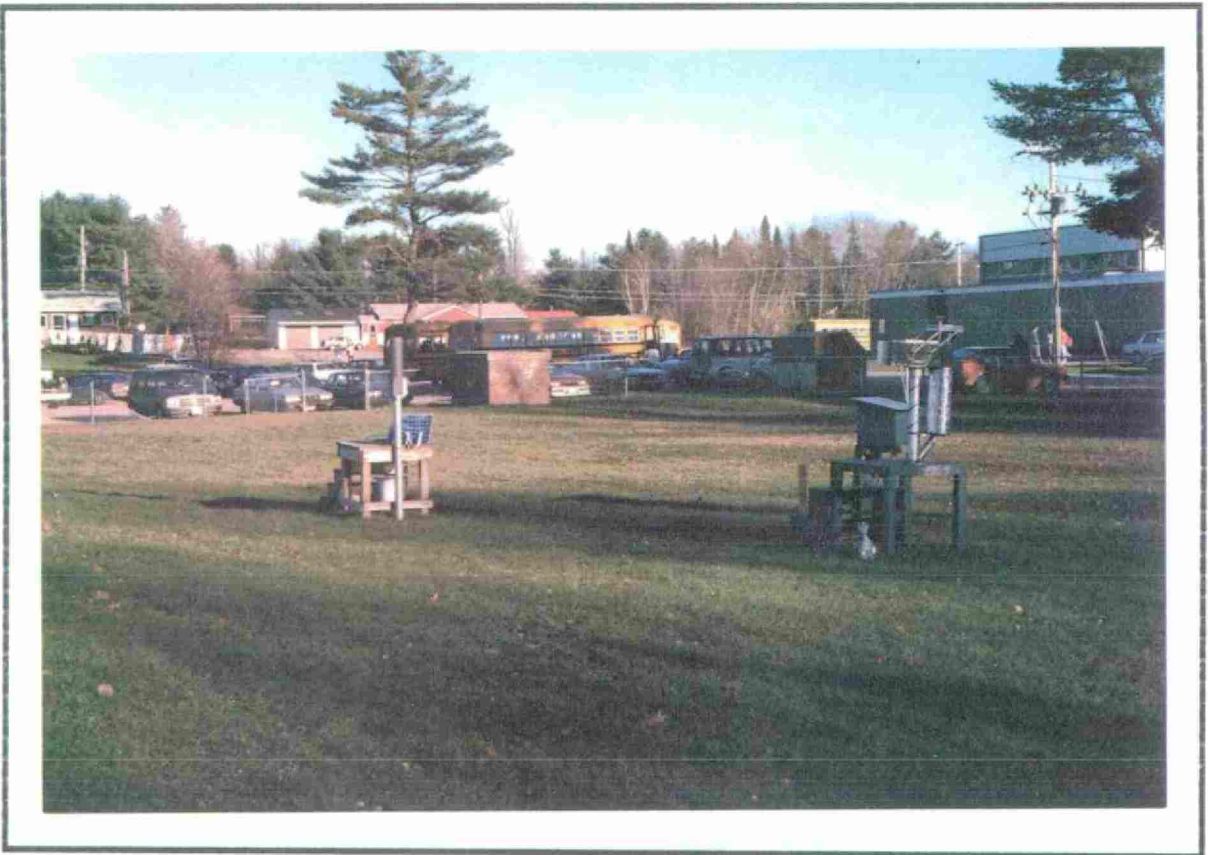
 CAMERA LOCATION AND DIRECTION

Plate 5
CLOYNE



Recommendations

The operator is in need of retraining by the regional technician. The regional technician should visit the operator on a periodic basis.

Regular site maintenance should be provided by the technician. Items which need immediate attention include the levelling of the monitors and Sangamo clutch adjustment.

Criteria for Improvement of Rating

The site rating cannot be appreciably improved at this location. Operator retraining, routine operator visits by the technician, and routine maintenance of site equipment would result in an operation rating upgrade to good.

2.1.3.2 Wilmer

Instrumentation. Event wet.

Siting (Rating: Good)

A site photograph and diagram are provided in Plate 6 and Figure 7.

The site is located behind a private residence in a clearing.

Smoke from a neighbouring wood-fueled residence was smelt on arrival to the site. The height of the trees (8-10 metres) in the windbreak exceed height criterion for samplers (horizontal distance less than 2.5 times the vertical height). Other potential influences on the sampler included a garden located approximately 25 metres south of the Aerochem and a tractor parked in the vicinity of the garden (combustion emissions during transit).

Recommendations

The siting could be improved by moving the collector further north into the clearing to remove it from the immediate influence of residence activities.

Operation. (Rating: Good)

There was a small rip in the hood gasket (the technician was informed) and the standard rain gauge was slightly off level. With the exception of these two minor items, the site is well maintained.

The operator is conscientious, follows standard procedures and notes occasions when wood burning might affect sampling. On occasions when the regional technician is not available to pick

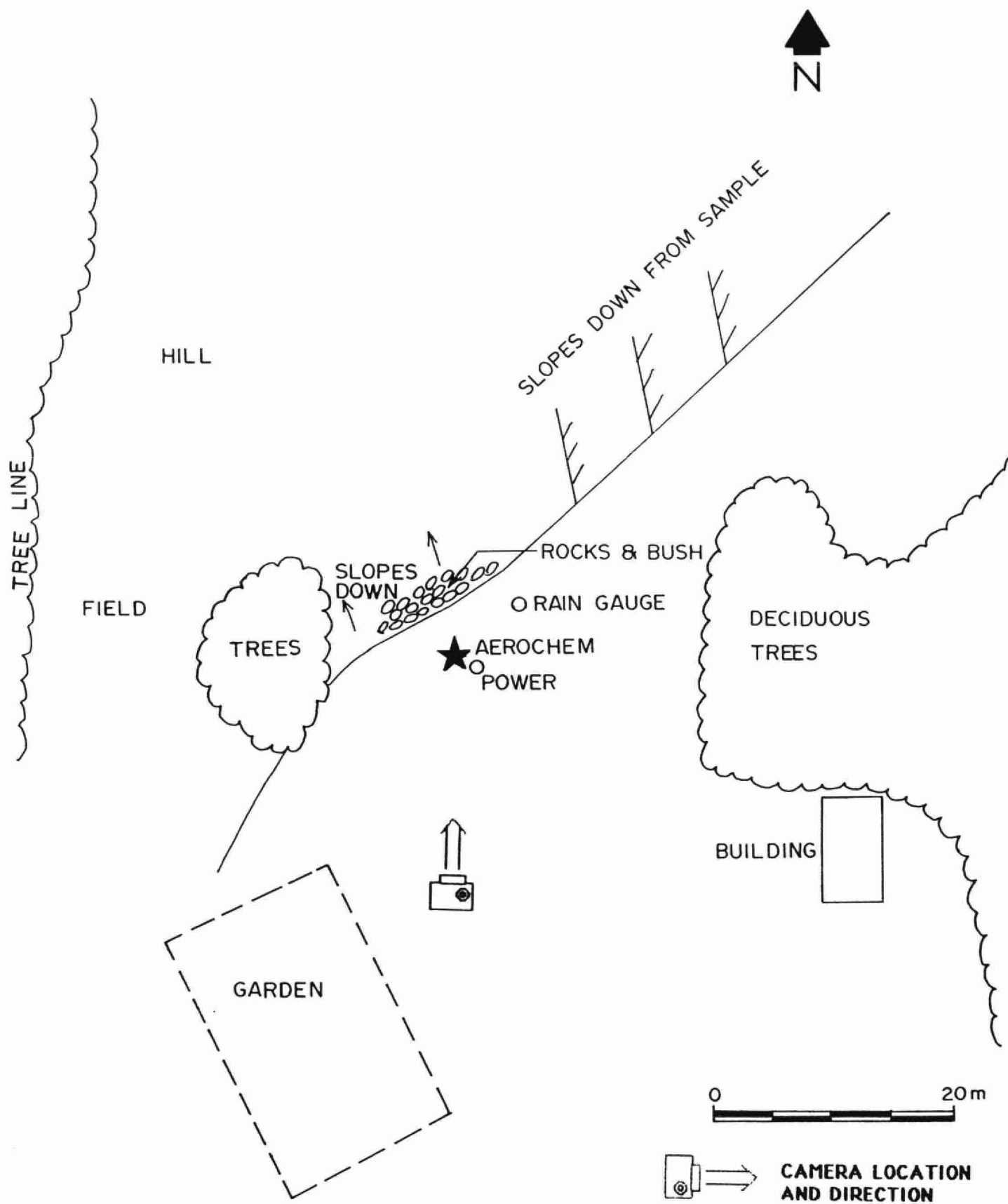


Plate 6

WILMER



up samples for a long period (i.e. in range of four weeks), she has them delivered by her husband to the Ministry's regional office.

Recommendations

The operator should be cautioned about the use of garden products and dust entrainment by the collectors and the potential of tractor or any other machinery exhausts that might lead to the contamination of the precipitation sample. Documentation of times when conditions might lead to contamination should be sufficient to ensure sample integrity.

2.1.3.3 Charleston Lake

Instrumentation. Event wet and dry.

Siting (Rating: Good)

A site diagram and photograph are provided in Figure 8 and Plate 7.

The site is located in a provincial park near the main park office and access road to the campsites.

There are some siting deviations of a local nature. A wood stove is used in the park workshop (approximately 100 metres from the monitoring site) during winter and MNR maintenance vehicles are idled in the vicinity of the site. Wind break trees have heights of up to 25 metres within 15 metres of the sampler. The site was audited in the fall. During the summer, when the park is operation, the siting rating might be reduced to marginal if traffic increases appreciably.

Operation (Rating: Good)

The equipment is well maintained and functioning properly. The regional technician or an assistant normally does the filter change on the event dry monitor on Tuesdays. During the audit, filters were not removed with a clean bag because the region ran out of supplies of this item. The technician's assistant did not check the Aerochem on this site visit. A separate operator is engaged to change sample bags on the wet event sampler. He was interviewed at the site and his responses indicated that he followed standard procedures.

There was small hole in the gasket cover of the Aerochem but otherwise the instrument is maintained properly and functioning. The operator had changed over from the standard rain gauge to the Nipher shield during the week prior to the audit which occurred on October 27th. This is a minor deviation from normal operating procedures.

CHARLESTON LAKE

Figure 8

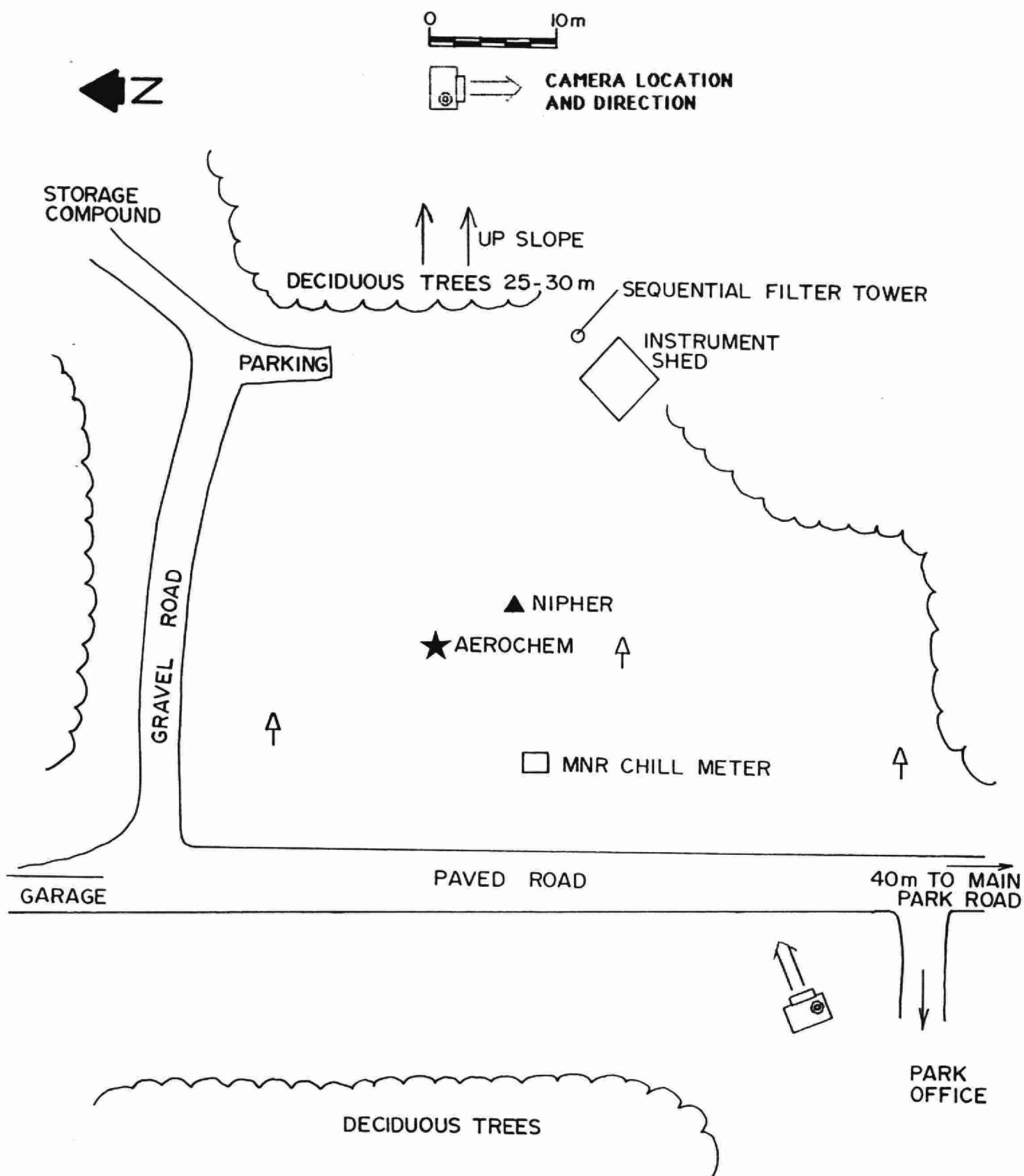


Plate 7

CHARLESTON LAKE



Recommendations

The regional office should ensure that adequate supplies are kept in order to operate the sites in accordance with standard procedures (i.e. in this case, plastic bags for filter packs were not available).

During visits to the site, the technician or his assistant should check and maintain all equipment.

2.1.4.3 Kingston Regional Office (Rating: Marginal)

The regional technician's workload is not completely devoted to the APIOS monitoring network. At the time of the audit, he was assisted by a contract employee who also worked part-time on the APIOS network. During the audit, renovations to the regional office had just been completed but office moves had not been finished. This influenced the auditor's rating of regional office performance. Under normal and stable conditions a poor rating would have been provided for comparable performance.

There were some departures from the normal pH measurement routine. Foremost, only pH4 buffer was used to calibrate the Radiometer meter (this instrument was not dedicated to APIOS and was borrowed during the audit from another section in the office). No other solutions were used to check proper operation of the pH meter. Secondly, the pH was measured directly in the sample container which had been left in the room to reach appropriate temperature. Although the pH probe was carefully washed during the audit with deionized water between measurements, this procedure increases the risk of contamination of the entire sample.

Cumulative and event samples are sent in styrofoam packs from the stations to the Kingston office. The event samples are not necessarily refrigerated when the APIOS storage capacity of 24 to 30 samples is exceeded. If room is available at the time in other refrigerators, the event samples are stored therein; otherwise they remain at room temperature. Biological degradation of samples is not deterred at room temperatures.

The normal routine of the technician or his assistant is to visit the Charleston Lake site every Tuesday and the wet event stations every two weeks. Normally, the technician indicated that procedural audits were carried out by him on an annual basis or when standard procedures were altered substantially. No documentation on sites is kept at the office such as pictures, aerial photographs, site questionnaires etc.

The regional technician indicated that instrument logs are normally maintained on a up-to-date basis; however, during the audit, they had been stored pending completion of regional office renovations and were not available for inspection.

Recommendations

Measurement procedures of pH should be reviewed by the Technical Coordinator once office routine has stabilized after the renovations.

Storage requirements at the office should be examined by the regional technician in consultation with the regional staff and the APIOS Technical Coordinator.

Hood gaskets should be maintained on a regular basis (as indicated by inspections at Charleston Lake and Wilmer).

Criteria for Improvement of Rating

After a procedural review by the APIOS Technical Coordinator, a rating of good could be assigned if the standard procedures are followed, operator training is conducted more thoroughly, site maintenance improved, and site documentation kept.

2.1.4 Northeast Region

2.1.4.1 Bear Island

Instrumentation Cumulative wet.

Siting (Rating: Marginal)

A photograph and diagram of the site is provided in Plate 8 and Figure 9.

The island site is located on an Indian Reserve next to the band office. The site is in close proximity to the lake waters.

There are various problems regarding siting of the sampler. Firstly, a power line stretches over the immediate vicinity of the sampler and directly over the unshielded Nipher gauge. This can lead to potential contamination of the sample from wash-off of dry deposition accumulation on the line and excess collection of precipitation in the Nipher gauge. Secondly, there is easy accessibility for children on the Island to tamper with the device. Large trees on the site and the building exceed height criterion for wet sampler location. A gas-powered mower is used to cut grass immediately in the vicinity of the collector and open burning occurs in a barrel 25 metres to the east of the sampler. Access to the site is restricted during break-up and freeze-up of the Lake.

Recommendations

It is recommended that the power line be relocated or the sampler moved a several metres to the west to minimize the potential of sampling line drips during rain events.

BEAR ISLAND

Figure 9

N. T. S.

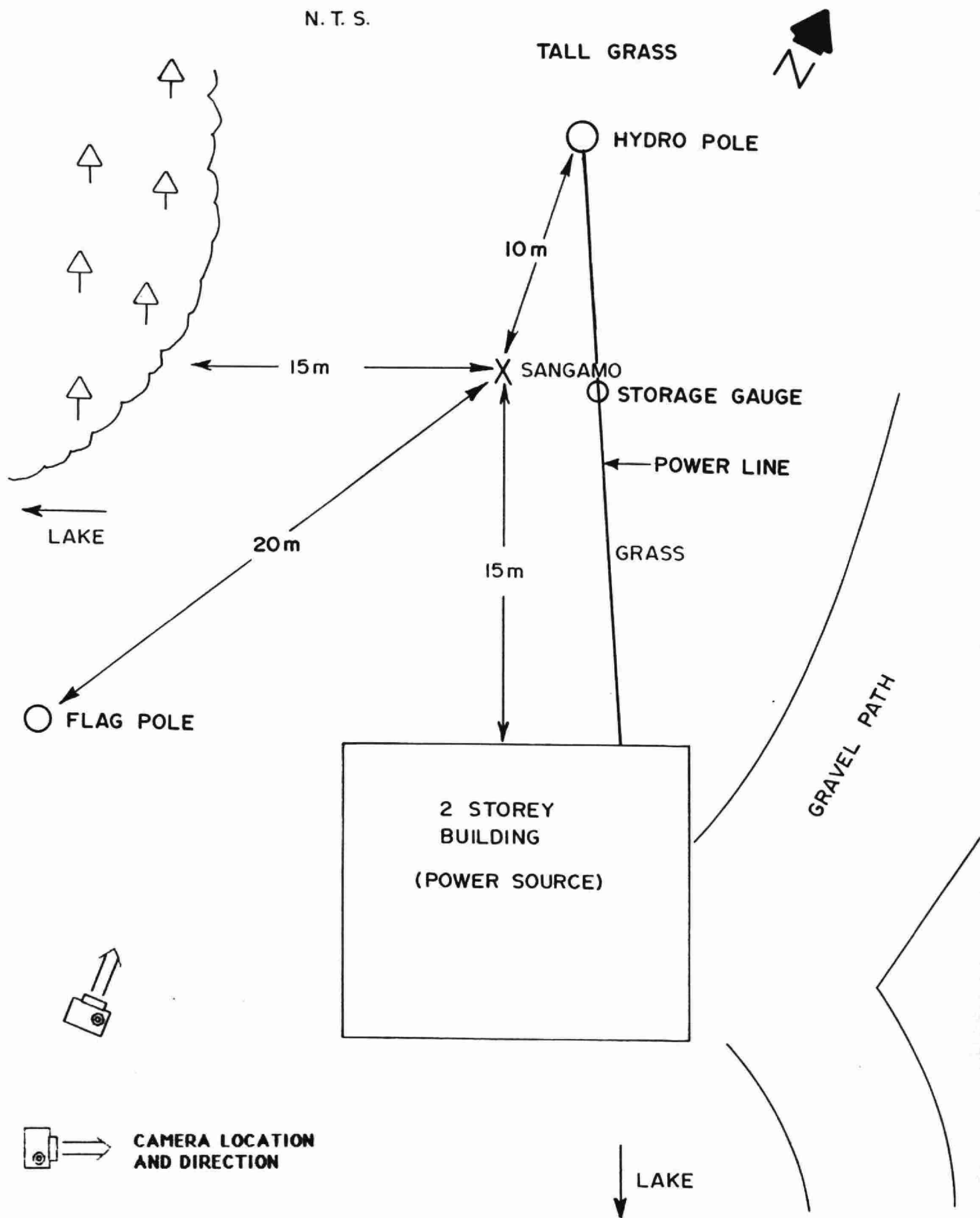


Plate 8

BEAR ISLAND



Operation (Rating: Marginal)

Over 40 pounds of pull was required to activate the hood clutch. All other aspects of the operation appeared well maintained (i.e. level monitors, smooth hood operation on Sangamo, etc.). The operator was audited regarding operation of the sampler. He was not sufficiently aware of the potential for sample contamination and appeared to be doing the sampling solely because he was assigned by the band. Although the sampler is next to the office, where the operator works, the sensor grids or hood gasket are never cleaned by the operator. Normally the Sudbury technician undertakes these duties but this means routine maintenance can be interrupted for 2 to 3 months per year because access is limited at freeze-up and break-up.

Recommendations

The operator should be retrained especially with regard to monitor maintenance.

The operator should be instructed to turn off the Sangamo when grass is cut and refuse is burned in the barrel to minimize sample contamination.

Criteria for Improvement of Rating

The operation can be upgraded to good if the recommendations are implemented. In order to upgrade the site rating to good, helicopter access would be required during freeze-up and break-up.

2.1.4.2 Turkey Lakes

Instrumentation. Cumulative wet and dry.

Siting. (Rating: Good)

A photograph of the site and its layout are provided in Plate 9 and Figure 10.

Turkey Lakes is remote from any concentration of anthropogenic activity. The site is located on the top of a forested hill.

The only source of emissions near to the site is the diesel generator which supplies power to the site. A water scrubber system reduces emissions of NO_x and particulates. This generator is located at a distance of about 250 metres downhill of the monitoring location. A gravel path that leads by the sampling equipment has had a layer of wood chips placed over it to prevent atmospheric entrainment of dust. (Wood chips release volatile organic compounds if newly cut but are not a problem over the long-term). All samplers, with the exception of the lo-volume sampling head, are mounted on a platform above ground level due to the large snowfall amounts. The meteorological

TURKEY LAKES

Figure 10
Not to scale

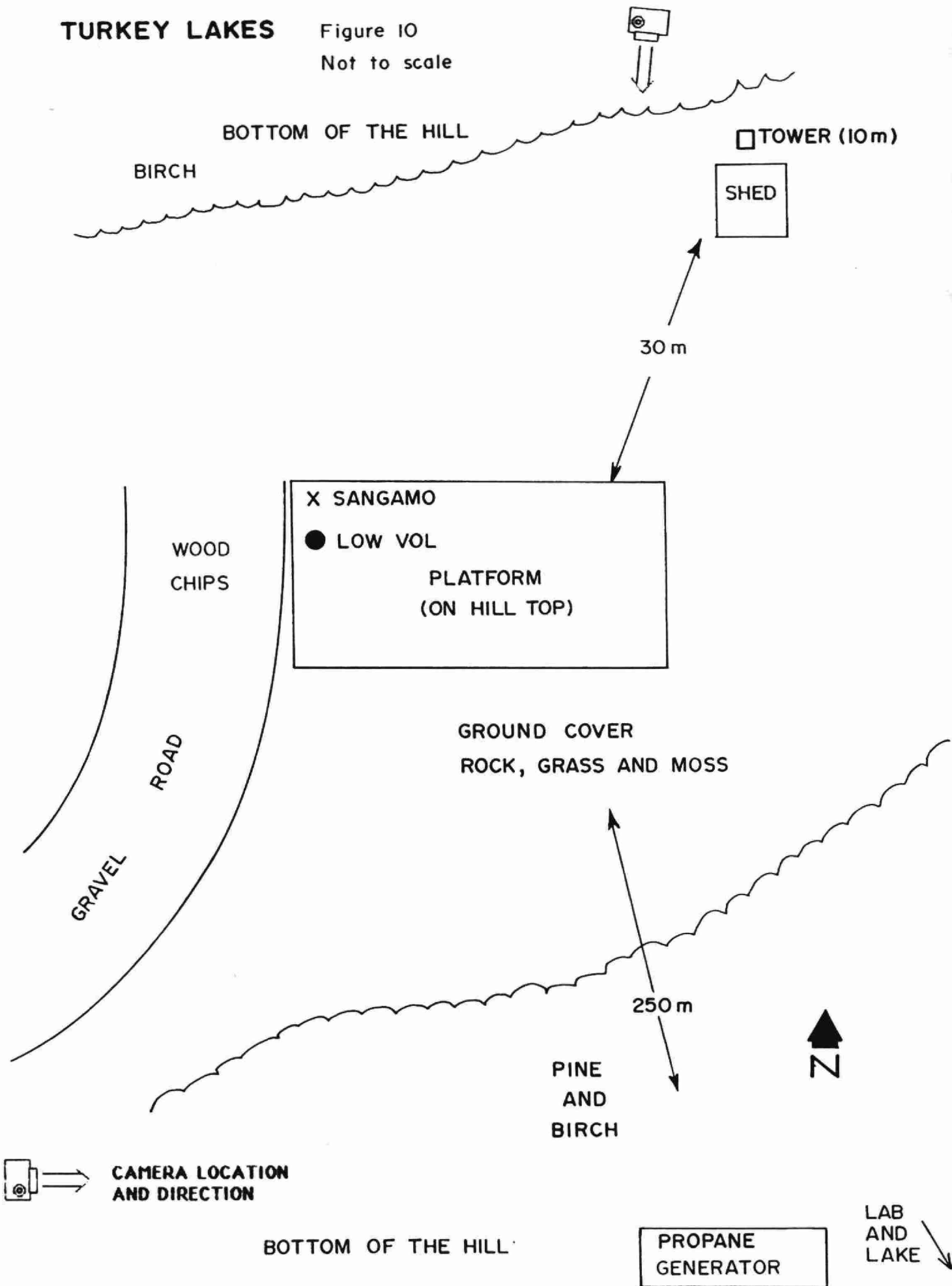
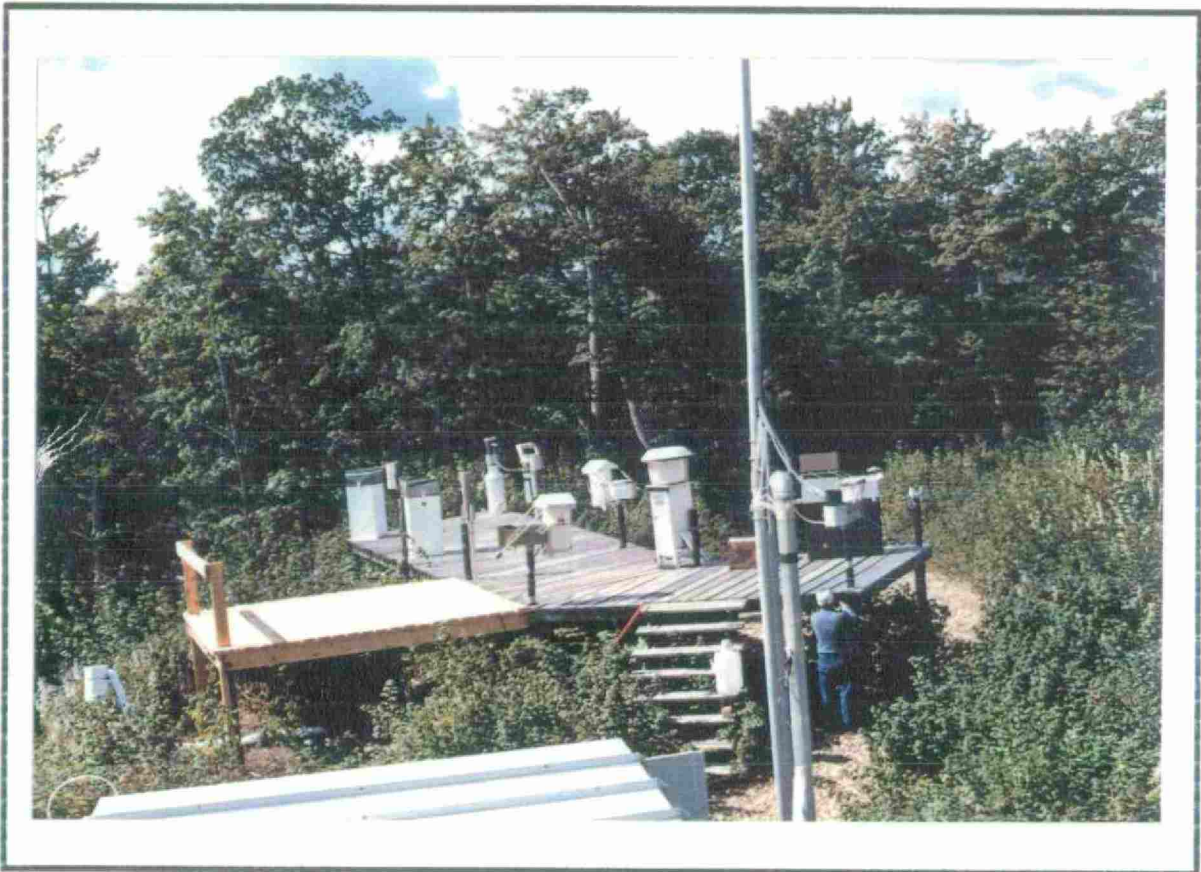


Plate 9

TURKEY LAKES



tower exceeds height criterion for wet samplers but does not likely affect sampling.

Recommendation

The feasibility of using solar and wind energy to power the equipment at this site rather than diesel/propane generators should be investigated.

Operation. (Rating: Excellent)

The operator at Turkey Lakes has a near full-time job taking care of various network samplers. He takes pride in his work and is particularly knowledgeable in operation of equipment in the field.

All equipment was well maintained and the operator followed standard procedures.

The recommendations of the operator were varied and they are provided in the following:

- (i) adapt CAPMoN style vacuum pull-down of bags to avoid contamination and any possibility of bag blow-out
- (ii) routine shipment of new hood gaskets and Vacushields automatically on a one or two month basis; shipping back used components as a method of ensuring replacement.
- (iii) institution of a bonus plan for good suggestions that are adapted into the network
- (iv) use another brand of gloves which are packed so that removal is by the glove end and not by areas that make contact with sampler surfaces.

2.1.4.3 Sudbury Regional Office (Rating: Good)

The technician spends 50 to 60 percent of his time on APIOS duties. At the time of the audit he was not assisted by any contract personnel. Performance of APIOS monitoring work was rated good since only minor deviations from standard procedures were observed in the Sudbury.

Forms, not yet quality assured by the technician, indicated some minor operator omissions such as a decimal place left out in the recorded gauge depth of 255 cm for Turkey Lakes and the omission of sampling start times on cumulative samples. The form for Bear Island is filled in by the technician not the operator.

Equipment logs are usually brought up to date twice a year e.g. not on a continuous basis as specified in the operations manual. The site descriptions are kept on file in the Sudbury office but were not available for inspection at the time of the audit.

Preventive maintenance procedures are practiced with the equipment such as checking limit switches and replacing Vacushields. Lo-volume samplers are calibrated routinely on a once a year basis. Because of pump failure there is usually more than one calibration per year per site.

The normal visiting routine is three times a year to cumulative sites. More remote locations, such as Moosonee, are visited twice a year. The technician has not conducted any procedural audits since he started his job.

When handling filters the technician does not use gloves and uses a cleaned lab bench for a work surface. With proper attention, there should be no problems; however, it is a departure from standard procedures.

There are some potential sources of contamination in the office/laboratory. There are sulphur dioxide permeation tubes in the room. This would only be a problem if leakage occurred concurrently during calibration of sulphur dioxide monitors and filters being dried. During the audit, plume downwash from the INCO stack was visible near the building and windows were open to the outside air with filter packs in the room.

Recommendations

Additional caution should be used during handling of samples and filters when potential sources of contamination are present (i.e. potential ambient-indoor air exchange during a fumigation event).

2.1.5 Northwest Region

2.1.5.1 Geraldton

Instrumentation. Cumulative wet and dry. Collocated wet.

Siting. (Rating: Good)

A location diagram and overview photograph are provided in Figure 11 and Plate 10.

The site is located at a remote compressor station location at the end of a 15 km gravel road from Geraldton.

The site would be classified as excellent except for the presence of the natural gas compressor station about 300 metres to the east. The installation is not in the prevailing wind direction. Gas turbines are used in the compressor station. Nitrogen oxides are likely the only air contaminant of concern. Although normal levels of emissions are low (based on information provided with site documentation) and the APIOS monitors are normally upwind of the station, there is the possibility of some influence. The heating fuel for the company residences is also

GERALDTON

Figure 11

FENCE

COMPRESSOR STATION



Po₈ Sb₂ 10m.

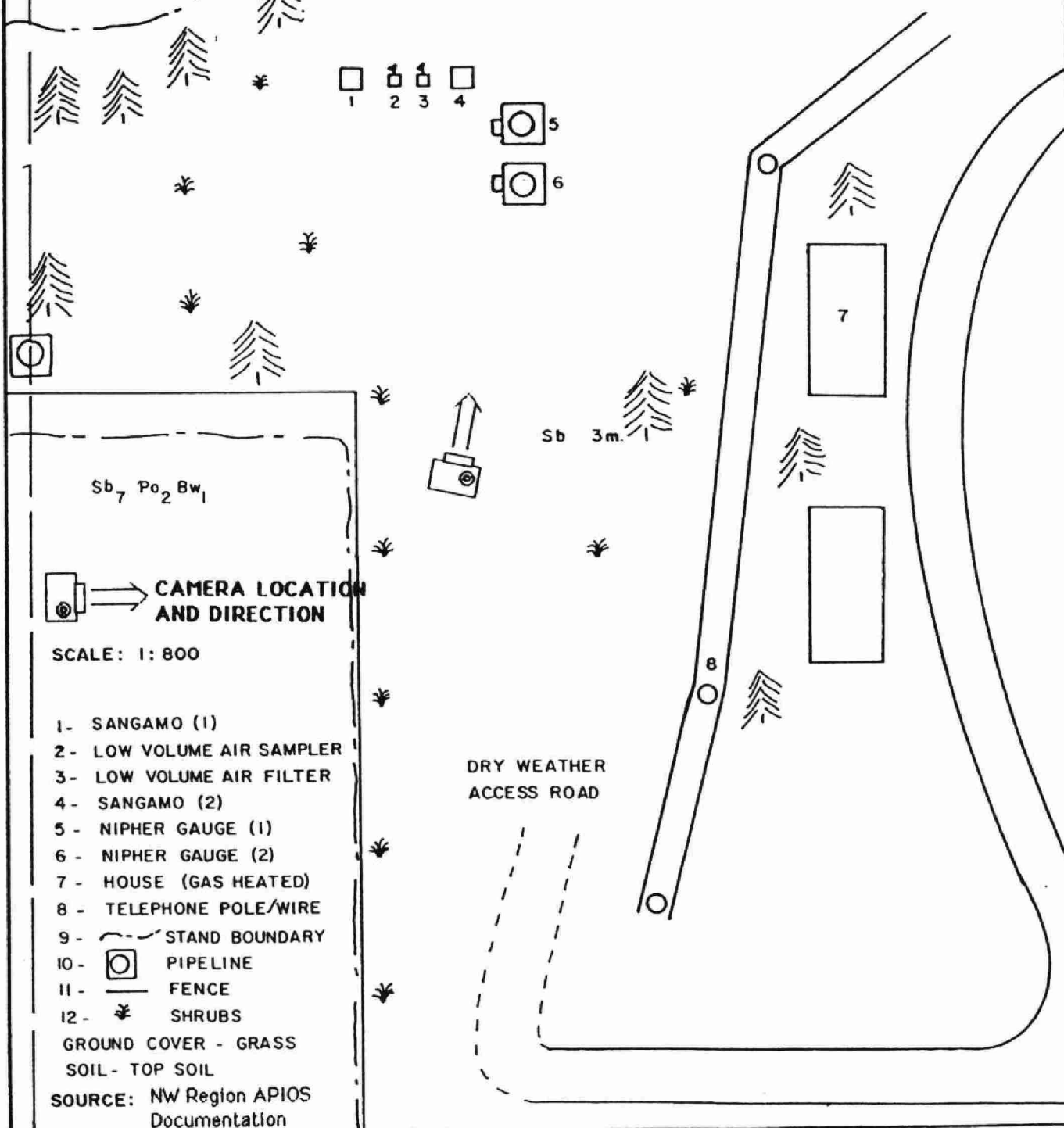


Plate 10
GERALDTON



natural gas. The use of calcium chloride on the gravel access road should keep dust generation to a minimum during dry summer periods.

Recommendations

A more thorough examination of the influence of the compressor station on sample representativeness should be undertaken. If representative, climatological data from the nearest hourly wind weather station could be used to drive a dispersion model which would provide a monthly estimate of concentrations at the APIOS site.

Operation. (Rating: Good)

The site operator had been looking after the site for 5 months. The operator indicated some interest in the APIOS monitoring network and paid attention to her responsibilities. She is not hesitant to call the regional technician for advice or for corrective maintenance. At the time of the audit in August she had not been briefed on winter operation.

Maintenance of the instruments on the site is adequate with some minor items needing attention such as out of level storage gauges and a missing guy wire on the lo-volume sampling head support. A dead bird was found in one of the storage gauges. This would affect the measurement of gauge depth.

The regional technician has visited the site about every six weeks in the last half year providing a good technical resource for the operator.

Recommendations

Storage gauges during the summer should be fitted with rings or other protective devices (such as the coarse screen used at Dorset) to minimize bird entrapment.

2.1.5.2 Dawson

Instrumentation. Collocated event wet.

Siting. (Rating: Good)

A location map and overview photograph are provided in Figure 12 and Plate 11.

The site is located in a rural area in a clearing on private property.

There are some minor deviations to siting criteria including a wood burning fireplace during the winter and the presence of the city of Thunder Bay, which has a thermal power plant and pulp and paper mills, within the 50 km criterion distance.

DAWSON

Figure 12

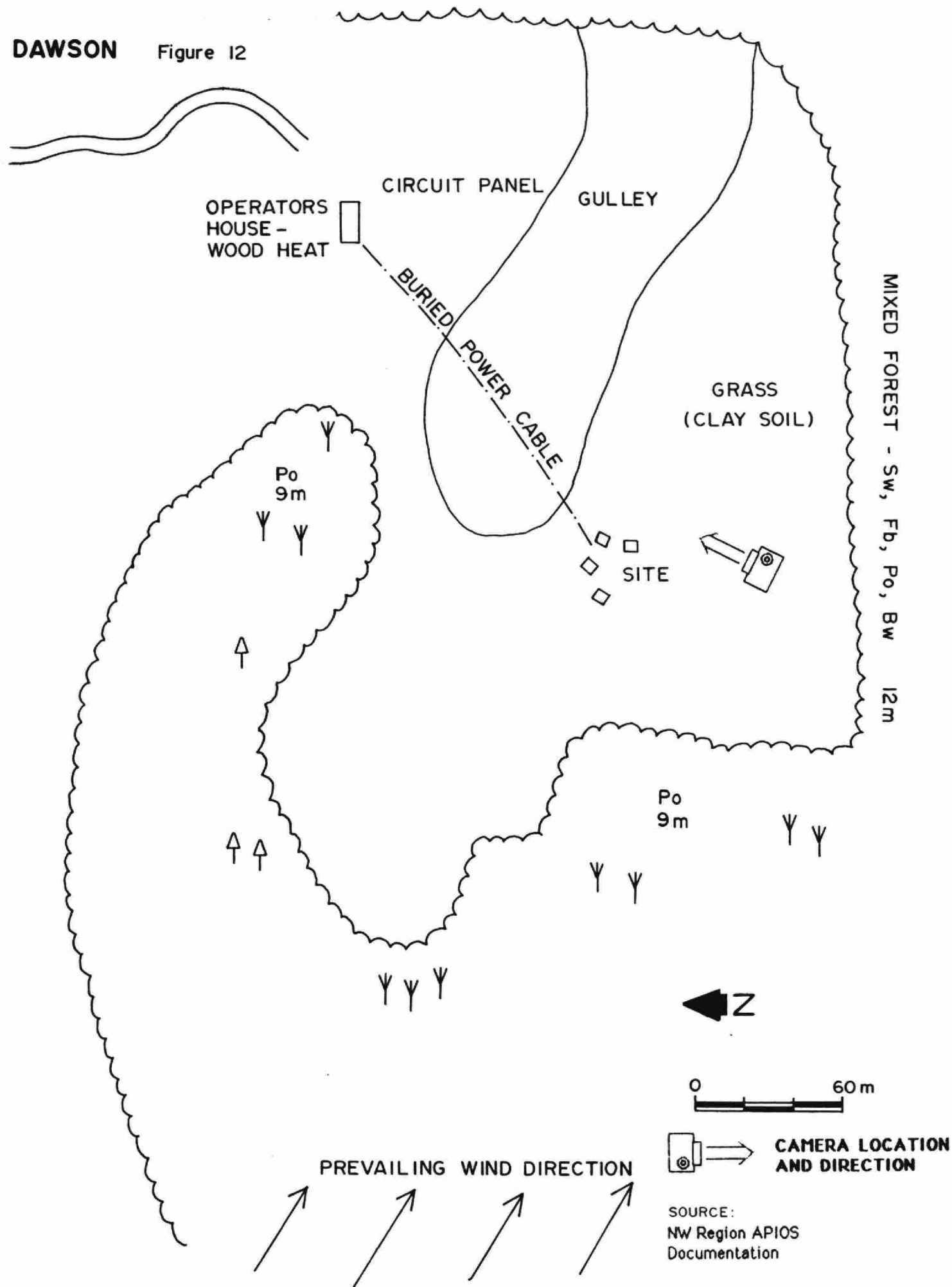
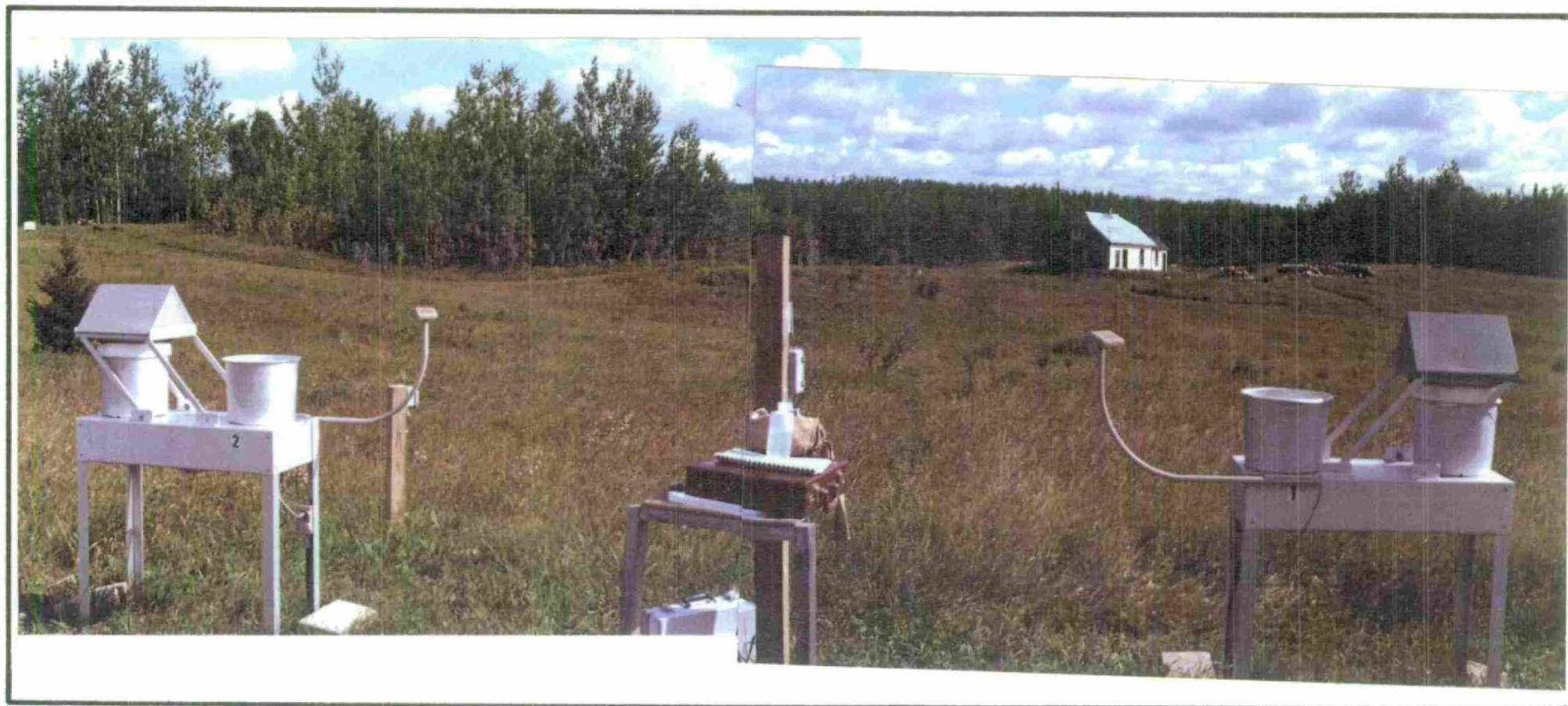


Plate 11

DAWSON



A gravel secondary road provides access to the farm and clearing where the monitors are located. Access by automobile during wet summer periods can be difficult up to the farm house because of the clay soil driveway. A greenhouse northwest of the monitoring site was being constructed during the audit. The operator indicated that the fuel for heating the greenhouse would be natural gas.

Operation. (Rating: Good)

The operator performed all procedures according to standards with some minor exceptions such as not reading precipitation levels in the middle of the meniscus rather than at the lower edge. The operator checks the sample bag for precipitation at 16:00 rather than the standard time of 08:00.

Equipment operation and layout were of greater importance in potentially affecting sampling results. One half of the sensor on Aerochem #1 did not respond to moisture. The heights of the two Aerochem Metric orifices were at different heights above ground level (1 and 1.3 metres). Finally, the electrical supply post may interfere with the proper operation of the Aerochem samplers.

The technician visits the site about once per month to collect samples, deliver supplies, and check instrumentation. This schedule should be frequent enough to maintain proper site operation.

Recommendations

Aerochem bucket heights should be standardized at the site and the electrical post shortened.

2.1.5.3 Fernberg

Instrumentation. Event wet and dry

Siting. (Rating: Excellent)

A location map and overview photograph are provided in Figure 13 and Plate 12.

The site is operated by the U.S. Forestry Service in a clearing on the top of one of the highest hills in the region.

The site is remote from intensive human activity and has a windbreak surrounding it. It does deviate from siting criterion in that it is one of the highest points in the region possibly leading to some topographic induced precipitation effects and more frequent downtimes due to lightning strikes. There is a large communications tower on the site but it does not likely affect sampling results. In the early summer periods of certain years the insect population is extremely high (not noticed to be

FERNBERG Figure 13

- 1- M.O.E. SEQUENTIAL AIR SAMPLER
- 2- M.O.E. AEROCHEM
- 3- M.O.E. STANDARD RAIN GAUGE
- 4- M.O.E. NIPHER
- 5- M.P.C.A. OZONE MONITOR
- 6- N.A.D.P. STEVENSONS SCREEN
- 7- N.A.D.P. STANDARD RAIN GAUGE
- 8- N.A.D.P. AEROCHEM
- 9- N.A.D.P. BELFORT RECORDING RAIN GAUGE
- 10- U.S.D.A.F.S. VISIBILITY MONITOR
- 11- M.P.C.A. PARTICULATE SO2 MONITOR
- 12- M.E.Q.B. BIO-INDICATOR PLOT
- 13- RADIO TOWER
- 14- STORAGE SHED

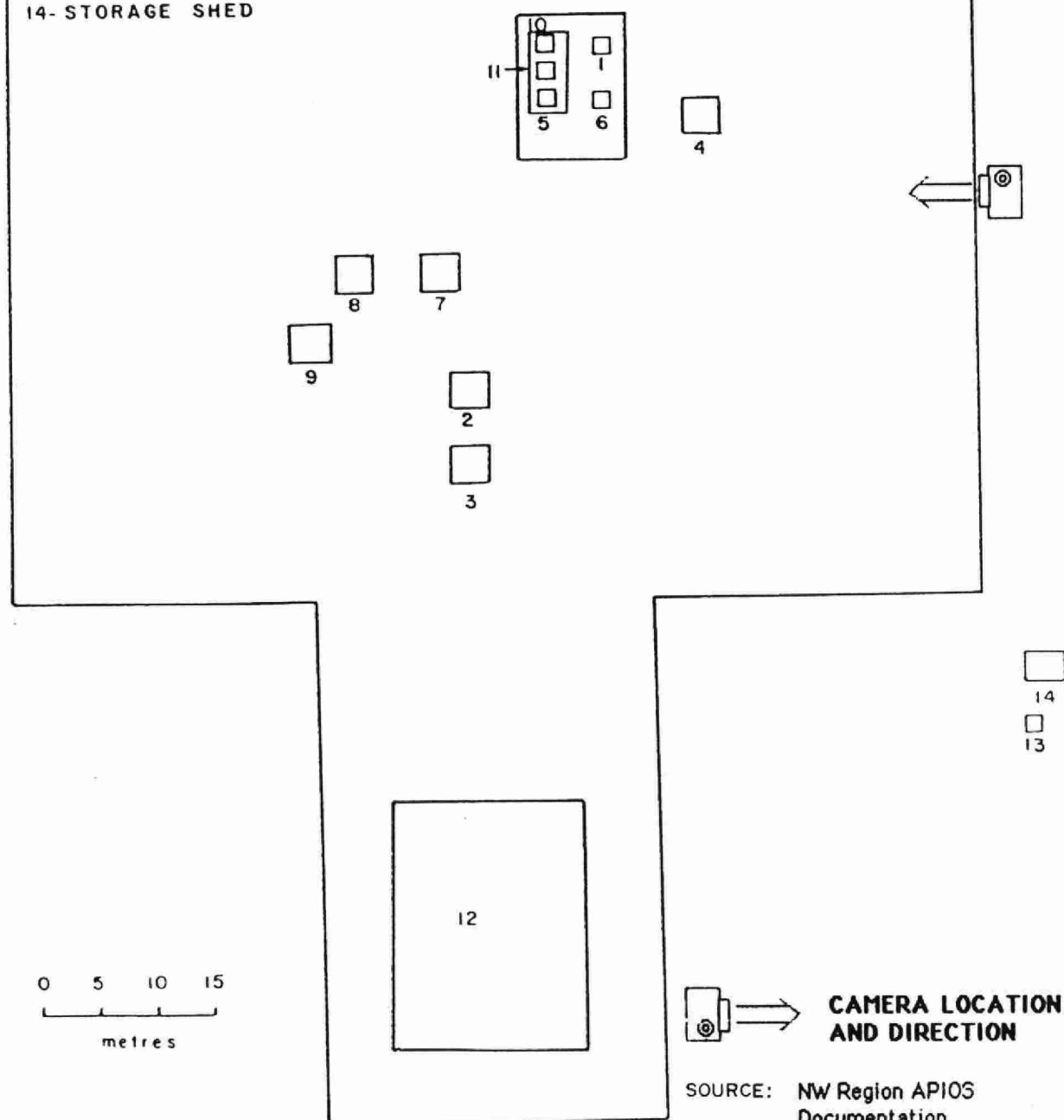


Plate 12
FERNBERG



a problem during the audit in August). During this season, the actual siting might be considered to be only good to marginal due to entrainment of biological material by samplers.

Operation. (Rating: Good)

There are separate operators for the wet and dry events. Both know standard procedures or demonstrated them. The site is visited on a regular basis every 5 to 6 weeks by the regional technician who sees the operators at this time, checks instrumentation and picks up samples.

The Aerochem was not closing properly during light rain at the site; the hood was oscillating between dry and wet. The technician repaired the unit during the audit. There was a 1/2 cm gap between the top of the bucket and the hood. It had been previously adjusted with pieces of wood underneath the collector bucket.

Recommendation

The hood should be adjusted so that there is a good seal on the bucket to prevent insect entrance.

2.1.5.4 Thunder Bay Regional Office (Rating: Good)

The APIOS responsibilities are carried out by a technician and periodically with additional contract staff. The contract employee was observed weighing samples and unloading filters. She was adequately trained for handling these duties.

The regional technician is almost totally dedicated to the APIOS network (80 percent of his normal work load).

The organization in the Thunder Bay facility was exceptional in the network. All sample handling was done in a dedicated room/office in the laboratory building. Files were well organized and easily accessible.

There is no schedule for hood gasket replacement; they are replaced as necessary.

Recommendation

Hood gaskets should be replaced on a regular interval to prevent the possibility of sample contamination. In this region, this may not be feasible for the more remote locations unless the recommendation of the Turkey Lakes operator is adapted.

2.2 Summary

2.2.1 Sites

The ratings of the various sites are summarized in Table 2.

2.2.2 Offices

Operations of the regional and APIOS offices were rated in relation to carrying out APIOS work. In London and Kingston, marginal ratings were assigned because of the minimal support given operators and the lack of site maintenance. A marginal rating was also obtained by the office in Toronto. Here procedures should be polished and in some cases reviewed to ensure compliance with standard procedures and assure data integrity. Finally, Dorset, Sudbury and Thunder Bay were given good ratings; only minor departures from standard procedures were found in these offices.

TABLE 2
SUMMARY RATING FOR SITES AND OPERATORS

Location	+ (site)		* (operation)	
	Poor	Marginal	Good	Excellent
Colchester		* +		
Longwoods		*	+	
Dorset			* +	
Uxbridge	* +			
Cloyne		* +		
Wilmer			* +	
Charleston L.			* +	
Bear Is.		* +		
Turkey Lakes			+	*
Geraldton			* +	
Dawson			* +	
Fernberg			*	+

3.0 SYSTEMS AUDIT

3.1 Status of 1984 Audit Recommendations

The status of recommendations affecting the 1987 audit and those related to performance were investigated by conversation with MOE and, where feasible, ascertained during site visits. The following provides the recommendations (in italic print) made by the auditors in 1984 (Concord Scientific Corporation, 1984) and what action has been pursued since that time (provided in normal print). Resulting recommendations by the present auditors are provided at the end of this sub-section.

1. Corrective action at audited sites with a marginal or poor rating.

The corrective action taken at poor or marginal sites is provided in the following:

Whitney - ground cover was exposed earth; the ground has naturally improved and is no longer considered a problem area

Winisk - site was removed from network because of poor performance

Whitman Creek - because no reliable power could be obtained it was removed from the network

2. Post "procedural short lists" at monitoring sites.

Site inspections in this audit indicate that this recommendation was not instituted on a network basis.

3. Inconsistencies in instrument configuration from region to region should be removed.

Some inconsistencies remain such as the heights of samplers but these are generally dictated by specific restraints of the site i.e. Turkey Lakes platform.

4. Service MLC samplers at Dorset

This recommendation was carried out.

5. Update network site documentation for the sites in the Central Region

This has been completed since that time.

6. *Regional technicians should continue to maintain close communication with operators, encourage operators to contact them for any reason and try to co-ordinate their site visits so that they can meet with the operators as often as possible.*

This remains a goal yet to be achieved across the province.

7. *Technicians should carry out procedures audit at least twice a year.*

This has not been implemented in the network and remains an area of concern although procedures have stabilized since the 1984 audit. Operator deficiencies in this audit were always connected with lack of rigorous procedural attention on the part of the regional technician.

8. *Operators should fill out operator sheets, monthly site summaries and log-books in duplicate, one copy should be retained for future reference and the second copy forwarded to the regional technician.*

This has occurred for operator sheets. Log-books are no longer prevalent in the network. They are not necessary.

9. *Quality Assurance Activity Log Sheet should be developed and implemented in network operations and procedures.*

One was developed and is used to write QA reports.

10. *Retraining sessions for technicians should be carried out at the next Quarterly APIOS technician meeting.*

These occur on a semi-annual basis or when changes occur.

11. *Technicians should visually check field data sheets for omissions and errors*

Technicians indicated that this was their routine procedure in this audit.

12. *Technicians should ensure that they have on hand at least the recommended instrument spare parts at all times.*

Six month supply lists are filled in to prevent shortages.

13. *Instruments in the Central region should be calibrated and serviced on a routine basis.*

This remains a problem in the Central Region (see Uxbridge audit) although students have been hired on a regular basis to assist.

Recommendations

Of the thirteen recommendations reviewed above, nine have had some positive action; the remaining four (numbers 2, 6, 7, 13) should be reconsidered for action to improve APIOS network operations. Particularly, procedural short lists should be developed for cumulative station operators who tend to their duties once every 28 days and technicians should conduct procedural audits twice a year (as recommended in 1984).

3.2 Documentation

In general, the site documentation supplied to the auditors was up-to-date and accurate but one notable exception was the complete absence of information on the Cloyne site. Whenever site documentation existed, EAG auditors generally agreed with the representation of the site and found the documentation complete and accurate; however, this does not indicate complete agreement with the particular selection of a site (refer to Section 2 of this report for specific recommendations).

3.3 Network Objective Compliance

Overall the network is operated in compliance with its general objective of having sites representative of the general geography within a 50 kilometre radius and trying to avoid local pollution influences within a one kilometre radius. Recommendations were made in this study to seriously consider the moving of the Uxbridge site because of local influences.

3.4 Network Organization at the Regional Level

The APIOS technicians in the regions report to the Chief of Air Quality Assessment or Senior Technician for that region. In most cases, they are assisted by a student helper or contract employee. The use of technician assistants is widespread and their training is of particular relevance to maintaining network standards. The auditors recommend that training standards be developed for temporary personnel assisting regional technicians. A job description for each contract person should be documented and the position should be noted in the organizational structure of APIOS.

The regional responsibilities of technicians is causing operational difficulties in the APIOS network. These problems are usually related to not being able to establish a fixed schedule for site visits, equipment maintenance, and documentation preparation. In addition, in most regions APIOS requirements are given a less priority than more immediate regional needs.

In the 1984 audit (CSC, 1984), it was expressed that regionalization "should ... improve many aspects of the field program by providing additional support to APIOS field activities, particularly in the remote areas of the province because other ministry employees will be able to assist in sample collection and maintenance." This has happened in the Northwestern Region and in a limited manner in the Northeastern Region but was not evident in any of the other regions.

Recommendation

A system of specifically allocating technician time and scheduling, worked out in concert with the regions, should be implemented for the APIOS network. If this is not feasible, a full-time APIOS technician might be retained to run a combined Southwest, Southeast monitoring district from Toronto or Dorset.

3.5 General Observations and Recommendations

There remains a problem with technical resource allocation in the network. Recommendations regarding negotiating specific technician time allocation with the regions have been put forward in the previous section. In most regions, student helpers or other contract employees are carrying out many of the duties originally allocated to technicians. A specific training program with documented verification for technician assistants should be instituted to ensure compliance with standard procedures.

Some network wide problems exist with equipment and its maintenance. Implementation of the following recommendations would improve the network's data capture rate. The Nipher gauges should be equipped with some mechanism to prevent bird entrapment. The replacement of Vacushields and hood gaskets should be based on a length of time which will minimize failure in the field.

The external auditor should be accompanied by an MOE representative from ARB (such as the Quality Assurance Coordinator) or by the Senior Technician or Air Quality Chief in the regions. This provides the best mechanism for agreeing on problems and formulating recommendations. This type of audit procedure is used in other acid rain related monitoring networks.

Sample analyses results should be provided to auditors in order to complete the evaluation of a site. This was not part of the work scope of this audit.

An external audit of site operation should be carried out under winter conditions.

4.0 REFERENCES

Concord Scientific Corporation, 1984. The Phase II Report of the Audit of the Acidic Precipitation in Ontario Study Deposition Monitoring Network. Prepared for Ministry of Environment, Air Resources Branch.

Bardswick, W., 1987. Acidic Precipitation in Ontario Study - Technical and Operating Manual APIOS Deposition Monitoring Program (1st Revised Edition). Ministry of the Environment, Air Resources Branch.

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